Memorandum

Michael Lindgren
Division Head

Accelerator Division
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Batavia, Illinois 60510-5011
USA
Office: 630.840.8409
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Date: October 8, 2020

To: Todd Sullivan

From: Michael Lindgren

Michael Lindgren, UID:mlindgre
Digitally signed by Michael Lindgren, UID:mlindgre
Date: 2020.10.08 14:24:32 -05'00'

Re: Approval for Running Booster

Safety documentation and procedures for restart of Booster operation are now complete and in place. Therefore, you are hereby authorized to run beam to the Booster.

cc: S. McGimpsey
E. McHugh
C.Y. Tan

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ADAP-11-0001
REV. 9

SYSTEM START-UP SIGN-OFF

The signatures below, unless noted in the comments section, indicate that the relevant systems are ready for the restart of beam operation. Indicate in the comments section any remaining work that would affect the restart of beam operations. Indicate N/A for departments that did not do any work on the system.

SYSTEM BEING SIGNED OFF: (Circle as Applicable)
Linac NIF MTA Booster [8-GeV Line-MI-10 Region] [MI-20-MI-62/Recycler] BNB NuMI P1-P2 Muon P3-Switchyard Meson Primary MT MC NM FAST _____

DEPARTMENT	DATE	SIGNATURE (Department Head/Designee)
1. Controls	10-1-2020	Amy Vogel for J. Patrick
2. Cryogenics	—	N/A
3. E/E Support	10/6/20	
4. RPO Manager	10/8/20	Madelyn Schoell, UID:maddiew Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.10.08 13:57:35 -05'00'
5. LSO	—	N/A
6. External Beamlines	—	N/A
7. Instrumentation	10/4/2020	
8. Interlocks	10-8-2020	
9. Main Injector	10/6/20	
10. Mechanical Support	2 Oct 2020	M Wong - Sqius
11. Muon	—	N/A
12. Operations	10/05/2020	
13. Proton Source	30 SEP 2020	
14. RF	10/6/2020	
15. ENG Support	10/01/2020	Paul C Garoufalo 01875
16. Target Systems	—	N/A
17. Shutdown Coordinator	10/7/20	8022

Comments and special conditions (please mark comment with department # to connect comment with appropriate department):

#8 - Interlocks - The Booster Logic has been tested in the "Dump Mode" only

RSO will lock Booster in Dump Mode until remainder of interlock tests are complete and MI 8 GeV approved for operation.

The Booster radiation shielding meets the requirements documented in the 2017 "Booster Shielding Assessment" shielding assessment.

FINAL APPROVALS

System Department Head Cheng-Yang Tan, UID:cytan Digitally signed by Cheng-Yang Tan, UID:cytan Date: 2020.10.08 14:14:31 -05'00' Date _____

Assigned RSO Susan McGimpsey Digitally signed by Susan McGimpsey Date: 2020.10.08 14:17:34 -05'00' Date _____

AD Division Head Michael Lindgren, UID:mlindgre Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.10.08 14:23:04 -05'00' Date _____

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ADAP-11-0001 Rev. 9

BEAM PERMIT
10/8/2020

Booster Accelerator Safety Envelope (ASE) Limit

The maximum hourly beam power transmitted through the Booster accelerator is limited to:
1.80×10^{19} protons per hr at 8 GeV.

No accelerator or beam line will transmit beam without an operational beam interlock safety system.

Booster Beamline Operating Limits

The maximum charge transmitted through the Booster is limited to:
2.70×10^{17} protons per hour at 8 GeV.

Examples: Charge/hr = number of pulses/hr x number of protons/pulse

#1 54,000 pulses per hour (15 Hz) at 5.00×10^{12} protons per pulse = 2.70×10^{17} protons per hour.

#2 36,000 pulses per hour (10 Hz) at 7.50×10^{12} protons per pulse = 2.70×10^{17} protons per hour.

Special conditions and comments:

Reviewed by Joe Compton, UID:compton — Digitally signed by Joe Compton, UID:compton Date: 2020.10.08 14:20:11 -05'00'
Operations Department Head

Reviewed by Cheng-Yang Tan, UID:cytan — Digitally signed by Cheng-Yang Tan, UID:cytan Date: 2020.10.08 14:13:16 -05'00'
Systems Department Head

Reviewed by Susan McGimpsey — Digitally signed by Susan McGimpsey Date: 2020.10.08 14:16:09 -05'00'
Assigned RSO

Reviewed by Madelyn Schoell, UID:maddiew — Digitally signed by Madelyn Schoell, UID:maddiew Date: 2020.10.08 13:58:43 -05'00'
ES&H Radiation Physics Operations Department Head

Approved by Michael Lindgren, UID:mlindgre — Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.10.08 14:24:08 -05'00'
Accelerator Division Head

Operator Signatures

Crew Chiefs

Crew A

Crew B

Crew C

Crew D

Crew E

Other

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Running Condition
Booster

October 8, 2020

Area RSO Sue McGimpsey

Mode of Operation Booster Operation

Beam Limits	**Beam Energy**	**ASE Limit**	**Operating Limit**
	8 GeV	1.80 E19 protons/hr	2.70 E17 protons/hr

Critical Devices B:MH1 & B:LAM

Enclosures Protected Booster, 8 GeV Line

Preferred Monitoring Devices* Booster intensity is monitored via B:CHGBBM
Booster Absorber intensity is monitored via B:BBMDMP

*Other methods of monitoring intensity may be used.

Requirements

Access Devices B:MH1 and B:LAM must be disabled in order to access Booster, or the 8 GeV enclosures.

Cool Off Period none

Special Interlocks The CDC Inputs including failure mode devices may all be found on the Safety System Status pages.

Special Concerns Any work performed on critical devices or obtaining a critical device key requires prior RSO approval.

There are two operating modes for Booster: Extraction to 8 GeV line and beam to the Dump (Absorber). In order to change modes from sending beam to the dump (absorber) to extracting beam to areas downstream, the Booster permit should be disabled, otherwise the interlock system may interpret the change as a failure.

Gates, Fencing and Passive Shielding Requirements There is no access to radiologically fenced areas without prior RSO approval.
Shielding, fencing and posting are in accordance with the 2017 "Booster shielding assessment".

Assigned RSO approval also signifies that all necessary Interlock Tests have been completed and Removable Shielding is installed.

Ops. Dept. Head Approval Joe Compton, UID:compton — Digitally signed by Joe Compton, UID:compton Date: 2020.10.08 14:19:33 -05'00'

Assigned RSO Approval Susan McGimpsey — Digitally signed by Susan McGimpsey Date: 2020.10.08 14:16:52 -05'00'

Sys. Dept. Head Approval Cheng-Yang Tan, UID:cytan — Digitally signed by Cheng-Yang Tan, UID:cytan Date: 2020.10.08 14:13:48 -05'00'

AD Head Approval Michael Lindgren, UID:mlindgre — Digitally signed by Michael Lindgren, UID:mlindgre Date: 2020.10.08 14:23:43 -05'00'

Operational Comments

Booster is able to run in two modes: MI-10 (MI) Mode and Dump Mode
B:BS809 is OUT for MI-10 Mode, and IN for the Dump Mode.

Based on thermal considerations, the repetition rate is limited to 7 Hz when sending beam to the absorber.

MCR must be appropriately staffed according to the Accelerator Safety Envelope.

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Instrument Information

Interlocked detectors (i.e., Chipmunk, FOX, Scarecrow, TLM, etc.) in "Integrate" mode that trip will not allow a safety system reset until sufficient time has passed to keep the hourly dose rate equal to or below the trip point setting. Interlocked detectors in "Integrate" mode that trip may be reset as the safety system allows. If there are more than ten trips by an interlocked detector in "Integrate" mode in one hour, RSO approval is required before reset.

MUX	Type	Location	QF	R/I Mode	Trip Level	CDC	Device(s) Tripped
0-203	Chipmunk	Booster East Fan Room (Short 12)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-227	Chipmunk	Booster Crossover at CUB (Short 19)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-232	Chipmunk	Booster/Linac W Gal Inersect (Long 22)	5	Integrate	2.5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-239	Chipmunk	Booster Per 1 Exit Stairwell (Short 1)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-250	Chipmunk	MI-8 Line in WBT (12' US of Buttress)	5	Integrate	0.4 mrem/hr	B:CRDEV	B:MH1 & B:LAM
0-251	Chipmunk	MI-8 Line on Berm (WBT)	5	Integrate	5 mrem/hr	B:CRDEV	B:MH1 & B:LAM
2-024	TLM	BSTR TLM1 Per 23, 24, 1		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-252	TLM	BSTR TLM2 Per 2, 3, 4		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-253	TLM	BSTR TLM3 Per 5, 6		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-205	TLM	BSTR TLM4 Per 8, 9, 10		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-206	TLM	BSTR TLM5 Per 11, 12, 13		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-220	TLM	BSTR TLM6 Per 14, 15, 16		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-221	TLM	BSTR TLM7 Per 17, 18, 19		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
2-025	TLM	BSTR TLM8 Per 20, 21, 22		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM
0-254	TLM	BSTR TLM3a Per 6, 7		Integrate	3,000 nC/min	B:CRDEV	B:MH1 & B:LAM

Note: QF only included for chipmmunks

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Other